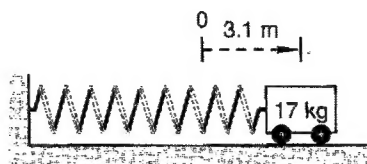


## Conservation Of Energy-Vibrating Springs

A perfect spring whose spring constant is 2300 newtons per meter is attached to a 17-kilogram object as shown. The object is moved 3.1 meters from its rest position and released. The object slides on a frictionless surface.

- 1) What will be its speed when it passes its rest position?

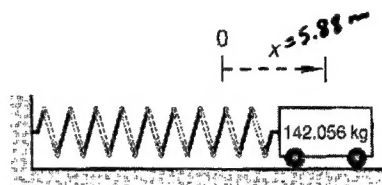


$$\frac{1}{2} kx^2 = \frac{1}{2} mv^2$$

$$v = \sqrt{\frac{kx^2}{m}} = \sqrt{\frac{2300(3.1)^2}{17}} = \boxed{36.05 \text{ m/s}}$$

A 142.056-kilogram object is attached to a perfect spring whose spring constant is 92.418 newtons per meter. The spring is stretched and released. The object slides on a frictionless surface. During the stretching, the system gains 1600 joules of energy. (a) What will be the speed of the object when it is 8 centimeters from its rest position?

- 2) (b) Find the amplitude of the vibration.



$$\frac{1}{2} kx^2 = 1600$$

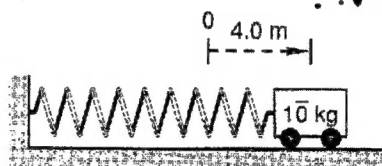
$$x = \sqrt{\frac{3200}{92.418}} = 5.88 \text{ m}$$

$$\frac{1}{2} (92.418) (0.08)^2 + \frac{1}{2} (142.056) v^2 = 1600$$

$$\therefore v = \boxed{4.74 \text{ m/s}}$$

A perfect spring whose spring constant is 454 newtons per meter is attached to a 10-kilogram object, as shown. The object is moved 4.0 meters from its rest position and released. The object slides on a frictionless surface.

- 3) What will be its speed when it passes its rest position?



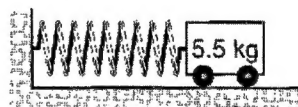
$$v = \sqrt{\frac{kx^2}{m}}$$

$$= \sqrt{\frac{454(4)^2}{10}}$$

$$= \boxed{26.95 \text{ m/s}}$$

A 5.5-kilogram object is attached to a perfect spring whose spring constant is 2500 newtons per meter. The spring is stretched and released. The object slides on a frictionless surface. During the stretching, the system gains 95 joules of energy. (a) What will be the speed of the object when it is 6.0 centimeters from its rest position?

- 4) (b) Find the amplitude of the vibration.



$$\frac{1}{2} (5.5) v^2 = 95 - \frac{1}{2} (2500) (0.06)^2$$

$$v = \sqrt{\frac{2(95 - \frac{1}{2} \cdot 2500 \cdot 0.06^2)}{5.5}}$$

$$= \boxed{0.738 \text{ m/s}}$$

A 12.5-kilogram object is attached to a perfect spring whose spring constant is 2650 newtons per meter. The spring is stretched and released. The object slides on a frictionless surface. During the stretching, the system gains 155 joules of energy. (a) What will be the speed of the object when it is 25.0 centimeters from its rest position?

- 5) (b) Find the amplitude of the vibration.



$$v = \sqrt{\frac{2(155 - \frac{1}{2} \cdot 2650 \cdot 0.25^2)}{12.5}}$$

$$= \boxed{3.3985 \text{ m/s}}$$

$$V = \sqrt{\frac{2(P_{\text{Elastic}} - 0.5Kd)}{m}}$$